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Length-Weight Relationships of Select Common Nearshore Southern California Marine Fishes

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Growth dynamics of marine fish is often critical for fisheries analysis. Frequently only lengths are measured during ecological surveys, occasionally with aggregate weights by species (Allen and Herbinson 1990; Pondella and Allen 2000; Allen et al. 2002). This information often allows for estimation of age-class composition through length frequency analysis, but can mask the importance of individual fish weights to the overall community structure, such as the inclusion of one, or a few, large individuals among a predominantly small catch. Over time, authors have reported length-to-weight relationships for specific species in the course of specific life history investigations, but these studies are rarely conducted on forage species. Cailliet et al. (2000) compiled many of the relationships that were available at the time, but numerous species still lack such basal information. Their database, however, contained 124 species, many of which did not have length-weight relationships available. Love et al. (2002) also compiled additional information on several rockfish species (*Sebastes* spp) and *Sebastolobus alascanus.*

Since 1979, impingement surveys at coastal generating stations routinely recorded the length of nearly all impinged fish during a given survey. Most of these surveys, however, recorded the aggregate weight by species, a protocol consistent with most ecological studies in southern California. Specific, focused studies were occasionally undertaken during which the individual length and weight of a subset of individuals were recorded. Moreover, instances when only a single individual of a specific species was impinged, a defacto length-weight relationship data point was recorded. During these studies the appropriate length; standard (SL), total (TL), or disc width (DW) was measured to the nearest millimeter (mm) and weight recorded to the nearest gram (g).

Data from impingement records 2001–2006, recorded at generating stations from San Diego County to Los Angeles County, California were reviewed to generate species-specific length-weight relationships (Tables 1 and 2). A total of 59 species were identified with length and weight recorded for greater than 10 individuals. These included both 54 ray-finned fishes (Class Actinopterygii) and 5 elasmobranch species (Subclass Elasmobranchii). All were common to the Southern California Bight (Miller and Lea 1972; Love et al. 2005). Forty-two of these species were included in the Cailliet et al. (2000) species list, but only 27 had a length-weight relationship listed.

The length-weight relationships of fishes typically fit the non-linear equation $W = aL^b$, where W = weight (g), L = length (mm), and *a* and *b* are derived constants. A best fit line was plotted for each distribution using MS Excel. The determination of the best fit was based on the R^2-value. Fifty-six species were best described by the traditional non-linear equation $W = aL^b$. Two species, *Anchoa compressa* and *A. delicatissima* were best described by a linear relationship and one species, *Seriphus politus*, was best described by an exponential function. The minimum and maximum length (mm) recorded for each

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Table 1. Length (mm)-weight (g) relationship, tightness of fit to the equation (R^2), sample size, and minimum and maximum length recorded for 54 fish species (Class Actinopterygii) collected during impingement sampling from Los Angeles County to San Diego County, California from 2001–2006, mainly 2006.

Species	Equation	R^2	N	Min. Len. (mm)	Max. Len. (mm)
Acanthogobius flavimanus	$Wt = 2E\text{-}05SL^{2.8272}$	0.84	67	70	183
Anchoa compressa	$Wt = 0.3SL\text{-}0.0164$	0.78	187	62	126
Anchoa delicatissima	$Wt = 0.2SL - 0.0123$	0.76	119	40	129
Anisotremus davidsonii	$Wt = 2E\text{-}05SL^{3.0457}$	0.99	45	41	327
Atherinops affinis	$Wt = 2E\text{-}06SL^{3.3046}$	0.96	1499	22	286
Atherinopsis californiensis	$Wt = 2E\text{-}055SL^{2.9051}$	0.89	668	48	342
Atractoscion nobilis	$Wt = 4E\text{-}05SL^{2.7991}$	0.98	65	64	420
Brachyistius frenatus	$Wt = 5E\text{-}06SL^{3.3596}$	0.93	22	70	128
Chilara taylori	$Wt = 1E\text{-}06SL^{3.2744}$	0.92	18	140	226
Chromis punctipinnis	$Wt = 2E\text{-}05SL^{3.1244}$	0.97	133	28	238
Citharichthys stigmaeus	$Wt = 2E\text{-}05SL^{3.0021}$	0.87	165	22	116
Cymatogaster aggregata	$Wt = 2E\text{-}05SL^{3.0583}$	0.95	824	29	161
Embiotoca jacksoni	$Wt = 8E\text{-}06SL^{3.3244}$	0.98	413	47	256
Fundulus parvipinnis	$Wt = 8E\text{-}05SL^{2.6197}$	0.87	14	48	70
Genyonemus lineatus	$Wt = 1E\text{-}05SL^{3.1249}$	0.98	389	28	252
Gibbonsia elegans	$Wt = 6E\text{-}06SL^{3.171}$	0.92	32	48	160
Gillichthys mirabilis	$Wt = 1E\text{-}04SL^{2.4415}$	0.87	112	25	154
Girella nigricans	$Wt = 2E\text{-}05SL^{3.124}$	0.98	21	75	332
Halichoeres semicinctus	$Wt = 5E\text{-}06SL^{3.2776}$	0.95	33	136	286
Heterostichus rostratus	$Wt = 7E\text{-}06SL^{3.0407}$	0.95	131	33	325
Hyperprosopon argenteum	$Wt = 1E\text{-}05SL^{3.2295}$	0.97	274	42	168
Hypsoblennius gilberti	$Wt = 6E\text{-}05SL^{2.7702}$	0.88	87	31	113
Hypsurus caryi	$Wt = 2E\text{-}05SL^{3.051}$	0.99	27	50	186
Leptocottus armatus	$Wt = 2E\text{-}05SL^{2.9422}$	0.94	326	32	185
Leuresthes tenuis	$Wt = 7E\text{-}06SL^{3.043}$	0.95	125	31	165
Medialuna californiensis	$Wt = 3E\text{-}05SL^{3.0106}$	0.97	12	145	224
Menticirrhus undulatus	$Wt = 2E\text{-}05SL^{2.9383}$	0.99	72	56	375
Ophichthus zophochir	$Wt = 1E\text{-}12SL^{5.1724}$	0.91	11	419	672
Ophidion scrippsae	$Wt = 4E\text{-}08SL^{3.9624}$	0.96	14	130	249
Oxyjulis californica	$Wt = 2E\text{-}05SL^{2.939}$	0.92	35	82	180
Paralabrax clathratus	$Wt = 4E\text{-}05SL^{2.9184}$	0.98	242	25	402
Paralabrax nebulifer	$Wt = 3E\text{-}05SL^{2.9802}$	0.99	150	27	435
Paralichthys californicus	$Wt = 8E\text{-}05SL^{2.6813}$	0.88	53	41	508
Peprilus simillimus	$Wt = 1E\text{-}05SL^{3.1729}$	0.90	160	45	175
Phanerodon furcatus	$Wt = 2E\text{-}05SL^{3.053}$	0.97	150	33	200
Pleuronichthys guttulatus	$Wt = 4E\text{-}05SL^{2.9106}$	0.99	61	27	375
Pleuronichthys ritteri	$Wt = 2E\text{-}05SL^{3.083}$	0.97	185	20	245
Pleuronichthys verticalis	$Wt = 3E\text{-}05SL^{2.9387}$	0.98	40	54	294
Porichthys myriaster	$Wt = 1E\text{-}05SL^{2.9407}$	0.97	230	19	476
Porichthys notatus	$Wt = 8E\text{-}06SL^{3.0692}$	0.98	25	37	266
Rhacochilus toxotes	$Wt = 2E\text{-}05SL^{3.0787}$	0.99	98	68	281
Rhacochilus vacca	$Wt = 4E\text{-}05SL^{2.9363}$	0.97	69	54	276
Scomber japonicus	$Wt = 8E\text{-}06SL^{3.0902}$	0.85	272	74	363
Scorpaena guttata	$Wt = 4E\text{-}05SL^{2.981}$	0.98	145	29	293
Scorpaenichthys marmoratus	$Wt = 3E\text{-}05SL^{2.9904}$	0.97	37	79	285
Sebastes auriculatus	$Wt = 2E\text{-}05SL^{3.0945}$	0.95	51	110	316
Sebastes miniatus	$Wt = 5E\text{-}05SL^{2.9095}$	0.99	12	39	290

Table 1. Continued.

Species	Equation	R^2	N	Min. Len. (mm)	Max. Len. (mm)
Seriphus politus	$Wt = 0.3e^{0.0373SL}$	0.93	3073	11	193
Sphyraena argentea	$Wt = 5E\text{-}06SL^{3.0316}$	0.97	31	45	406
Symphurus atricaudus	$Wt = 8E\text{-}04SL^{2.0957}$	0.91	18	22	179
Synodus lucioceps	$Wt = 4E\text{-}06SL^{3.1072}$	0.87	85	26	221
Trachurus symmetricus	$Wt = 7E\text{-}06SL^{3.1246}$	0.91	159	60	241
Umbrina roncador	$Wt = 3E\text{-}058SL^{2.9233}$	0.99	73	72	301
Xenistius californiensis	$Wt = 2E\text{-}05SL^{3.0349}$	0.94	265	29	173

Table 2. Length (mm)-weight (g) relationships of fit to the equation (R^2), sample size, and minimum and maximum length recorded for five elasmobranch (Subclass Elasmobranchii) species collected during impingement sampling from Los Angeles County to San Diego County, California from 2001–2006, mainly 2006.

Species	Equation	R^2	N	Min. Len. (mm)	Max. Len. (mm)
Heterodontus francisci	$Wt = 9E\text{-}06TL^{2.9948}$	0.98	19	112	750
Myliobatis californica	$Wt = 1E\text{-}05DW^{3.0436}$	0.95	446	167	885
Platyrhinoidis triseriata	$Wt = 7E\text{-}06TL^{2.9774}$	0.98	102	115	670
Torpedo californica	$Wt = 7E\text{-}05TL^{2.7748}$	0.90	50	185	932
Urobatis halleri	$Wt = 3E\text{-}05DW^{3.1312}$	0.88	960	68	366

species was included, as some of these relationships may not fully encapsulate the total available size range commonly occurring in the Southern California Bight. These relationships were not compared to previous published results, but rather presented purely based on the available data recorded during impingement surveys so as to represent a recent assessment of length-weight relationships of common marine fish.

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